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Assessment of hybrid renewable power sources for rural electrification in Malaysia

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ABSTRACT

Research works on hybrid renewable energy systems for rural electrifications have been quite intensive in recent years. Traditional power systems for remote or rural areas are based on fossil fuels. After addition of renewable energy resources, solar energy applications have become popular in remote energy systems. The recent study and research works show that adding other possible renewable energy resources such as wind, hydro and biomass could make a hybrid system more cost-effective and environmentally friendly. Hence, in the present study, an overview of applied hybrid renewable energy system (HRES) for worldwide villages with special attention on Malaysia has been proposed to help present and future works for better achievement in this field. Furthermore, a proper design and analysis for one village in Malaysia based on proposed combination is provided. The results show that combination of photovoltaic-wind -battery is defined as a cost-effective HRES for villages in Malaysia.

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1. Introduction

Approximately twenty percent of global population or 1.3 billion people are living without electricity in the world. In developing countries in Asia, the percentage is around 36% of the total population. Furthermore, the number of people without access to the electricity will remain high at around 16% of total by 2030 [1]. Thus, rural electrification with the proper energy system in this part of Asia is an urgent issue in the energy sector [2].

Although the first solution for rural electrification is the extending of national grid by power transmission line, but in some cases it is not a possible solution [3]. According to the World Bank, grid extension prices vary from $6340/km in a densely populated country to $19,070/km in other countries [4]. Hence, the

Abbreviations: RE, renewable energy; PV, photovoltaic; RES, renewable energy system; HRES, hybrid renewable energy system; RETs, renewable energy technologies; HOMER, hybrid optimization model for electric renewable; HOGA, hybrid optimization by genetic algorithms

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